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Dr. Paul Rispin, Program Manager
Office of Naval Research, Code 331
875 North Randolph Street, Room 273
Arlington, VA 22203-1995

Subject: Deliverable Number 0003, Technical Plan

Reference: Strategic Mobility 21 Contract N00014-06-C-0060

Dear Paul,

In accordance with the requirements of referenced contract, we are pleased to submit this Technical Plan for your review.

Your comments on this document are welcomed.

Regards,

Dr. Lawrence G. Mallon
Strategic Mobility 21 Program Manager

cc: Administrative Contracting Officer (Transmittal Letter only)
Director, Naval Research Lab (Hardcopy via U.S. Mail)
Defense Technical Information Center
Stan Wheatley

6300 State University Drive, Suite 220, Long Beach, California 90815
562.985.7394 • 562.985.2583 Fax • www.ccdott.org

Strategic Mobility 21

Technical Plan

Contractor Report 0003

Prepared for:

Office of Naval Research
875 North Randolph Street, Room 273
Arlington, VA 22203-1995

Dr. Paul Rispin, Program Manager, ONR Code 331
703.696.0339 rispinp@onr.navy.mil

In fulfillment of the requirements for:

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Prepared and Submitted by:

Dr. Lawrence G. Mallon, Program Manager
California State University, Long Beach Foundation
6300 State University Drive, Suite 220 • Long Beach, CA 90815
562.985.7392

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This Technical Plan addresses the Strategic Mobility 21 (SM21) program technical management parameters and technical approach. The SM21 program is managed as a modified DoD Advanced Concept Technology Demonstration (ACTD). The SM21 Joint Operational Concept Document (JOCD) describes SM21 as a 4-year, dual-use program, identified as a Joint Advanced Logistics Technology Demonstration (JALTD). The principal guidance for the SM21 JALTD is the Project Management Plan (PMP) with Annex A, the Initial Capabilities Document (ICD) and this Annex B, the Technical Plan, which is based on the technical requirements analysis associated with the DoD Joint Staff - Joint Logistics (Distribution) Joint Integrating Concept (JIC) and the SM21 ICD. The Technical Plan provides a top-level description of the demonstration including the vital objectives, approach, critical events, participants, schedule, and transition objectives. Measures of effectiveness and performance evaluation, to be considered in addressing both effectiveness and suitability of the dual use distribution capability, are defined.

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Abstract

This Technical Plan addresses the Strategic Mobility 21[1] (SM21) program technical management parameters and describes the program's technical approach. The SM21 program is being managed as a modified Department of Defense (DoD) Advanced Concept Technology Demonstration (ACTD). The SM21 Joint Operational Concept Document (JOCD) describes the structure of the SM21 program as a four-year, dual-use[2] program and has been named a Joint Advanced Logistics Technology Demonstration (JALTD). The principal management guidance for the SM21 JALTD is the Project Management Plan (PMP) with Annex A, the Initial Capabilities Document (ICD) and this Annex B, the Technical Plan. The Technical Plan is based on the technical requirements analysis associated with the DoD Joint Staff - Joint Logistics (Distribution) Joint Integrating Concept (JIC) and the SM21 ICD. The Technical Plan provides a top-level description of the demonstration with sufficient detail to ensure the vital objectives, approach, critical events, participants, schedule, and transition objectives are understood and agreed upon by all relevant parties. Measures of effectiveness and performance evaluation, to be considered in addressing both effectiveness and suitability of the dual use distribution capability, are defined.

[1] Strategic Mobility 21 is a Congressionally mandated and independently funded applied research program through the Office of Naval Research. The program is conducted under the auspices of the Center for the Commercial Deployment of Transportation Technologies (CCDOTT), a government-industry academic collaborative enterprise.
[2] Dual-use technology serves as a basis for both commercial and military products.

SECTION 1

1.0 Overview

1.1 Purpose

The purpose of this Technical Plan is to address the technical management parameters of the Strategic Mobility 21[3] (SM21) program and to describe the program's technical approach. The SM21 program will be managed as a modified Department of Defense (DoD) Advanced Concept Technology Demonstration (ACTD) and will follow the basic guidance issued for the development and execution of ACTD Programs. As outlined in the SM21 Joint Operational Concept Document (JOCD), SM21 is structured as a multi-year; dual-use[4] program defined as an Advanced Logistics Technology Demonstration (JALTD). The principal management guidance for SM21 is the Project Management Plan (PMP) with Annex A - Initial Capabilities Document (ICD) and this Annex B - Technical Plan. This plan is based on the technical requirements analysis associated with the DoD Joint Staff - Joint Logistics (Distribution) Joint Integrating Concept (JIC) and the SM21 ICD contained in Annex A.

This Annex consists of four sections with two appendixes as outlined below:

- Section 1 Overview: Provides an overview of the technical plan and includes the program structure, and technical plan update process.
- Section 2 Overall Approach: Provides an overview of the commercial and military capability gaps being addressed by the program, identifies the associated capability evaluation process, and outlines the potential experimentation efforts for the current program year.
- Section 3 Technologies, Processes, and Technical Approach: Provides a review of the emerging and advanced technologies to be considered, the program technical approach, the measures of effectiveness and performance to be employed, technical risk assessment, program affordability, system interoperability, program assessments, demonstrations, and the simulation aspects of the program.
- Section 4 Programmatic and Organizational Approach: Provides the technical management plan including requirements management, development strategy, rapid development techniques to be employed, program configuration management, and Calendar Year 2006 critical events.
- Section 5 Systems Engineering Plan: Provides the SM21 JALTD systems engineering plan.
- Appendix A Risk Management: Provides the methodology for future SM21 JALTD risk identification, assessment, and treatment and provides an SM21 risk evaluation table.
- Appendix B Technical Committee Decision Document: Provides for the modified use of

[3] Strategic Mobility 21 is a Congressionally mandated and independently funded applied research program through the Office of Naval Research. The program is conducted under the auspices of the Center for the Commercial Deployment of Transportation Technologies (CCDOTT), a government-industry academic collaborative enterprise.
[4] Dual-use technology serves as a basis for both commercial and military products.

the IPT decision document as a Technical Committee decision support document.

SM21 is structured to conduct a series of experiments, demonstrations, and annual assessments that will be used to design and potentially after transition build a dual use inland terminal facility at Victorville, California located on the former George Air Force Base. Following the guidance of an ACTD, SM21 will provide for process change and the physical infrastructure design necessary to maintain the competitive status of ports in Southern California and to meet increasing demands for dual-use service. Modeling, simulation and experimentation will be used extensively to evaluate the capabilities associated with program objectives. Experimentation will be employed as a process to combine and structure the required SM21 capabilities and steer future experimentation activities.

The SM21 Technical Plan is based on the DoD ACTD tenet of maintaining a flexible approach to the advanced development process and to avoid excessive rigidity and formality in documentation and process. Hence, this Technical Plan is an executive-level document, written in informal, primarily non-technical language. Since it is a plan; it is not intended to be immutable, as modifications may be warranted from time to time. However, all substantive (i.e., schedule, content, objectives) changes require approval and documentation by the SM21 Technical Committee using the format provided at Appendix B to this Annex and as further discussed in this Annex.

1.2 SM21 JALTD Program Structure Overview

The SM21 JALTD Technical Plan provides a top-level description of the demonstration with sufficient detail to ensure the vital objectives, approach, critical events, participants, schedule, and transition objectives are understood and agreed upon by all relevant parties. Measures of effectiveness and performance evaluation, to be considered in addressing both effectiveness and suitability of the dual use distribution capability, are defined.

The SM21 JALTD includes a dual-use capabilities demonstration and evaluation process in which the development and employment of commercial distribution technology and innovative operational concepts by the military and commercial user is the primary focus. SM21 will exploit mature and maturing distribution management technologies to solve the important military force deployment and joint commercial and military distribution problems with an initial focus on Southern California. The SM21 JALTD will concurrently develop the associated distribution concepts and business processes to permit the technologies to be fully exploited. These capabilities, operational concepts, and business processes will then be evaluated in a series of simulations and experiments followed by an initial commercial and military capability demonstration in the spring of 2007. The early demonstration and evaluation will be accomplished in a real-time operation in the Pacific Northwest[5] during a large scale military force deployment to clearly establish the operational utility and initial SM21 system integrity.

[5] The Pacific Northwest demonstration will be a cooperative event with the Center for the Commercial Deployment of Transportation Technologies' Agile Port System (APS) program. The APS program has previously completed a commercial only demonstration at the Port of Tacoma, Washington United Terminal.

1.3 Approach for Technical Plan Updates

It is anticipated that the Technical Plan will be updated as the program meets major milestones and moves between project phases. As a minimum, the Technical Plan will be reviewed quarterly for update as part of the ONR Quarterly Program Review process and prior to beginning a new fiscal year program. The Technical Plan will also be updated after final agreement is reached with USTRANSCOM on the timing and scope of the PNW force deployment demonstration scheduled for the late winter-early spring 2007 time period. The PNW demonstration plan will be documented in an Appendix to this Technical Plan during a future update.

SECTION 2

2.0 Capability Gaps

2.1 Capability Gaps Identified for Consideration

Integral to this JALTD is the direct linkage between the commercial and military operational logistician, the users, and the war-fighting Combatant Commands (COCOMS) who define their entities logistics requirements. The SM21 JALTD will address the following military and commercial capability gaps identified during literature reviews, analysis of after action reports and lessons learned in Operation Iraqi Freedom, and the SM21 capability based assessment process.

The capability gaps that have been identified for further considered by the SM21 JALTD include issues and functionality associated with:

- Hierarchical, stove-piped logistics chains which cannot support distributed, adaptive operations
- Existing logistics information architecture that is focused on the port-to-port and not the end-to-end distribution process
- The lack of a single platform to track in-transit visibility at ground level and for input to higher level enterprise architecture for decision support
- The lack of dynamic network visibility to locate and determine status of assets across network
- DOD Automated Identification technology (AIT) use that is sub-optimized through inadequate business processes
- Current marshaling and staging procedures at US Strategic Ports that add disruptions to commercial operations
- Limited synchronization of vessel stowing at strategic ports, inter-theater movement, and "arrival to flow" through Reception, Staging, and Onward Movement at Sea Ports of Debarkation (SPOD)
- Limited use of combining asset identification technology with information flow monitoring transportation equipment movement

- No wide area network information architecture template that can be rapidly deployed to extend asset and shipment visibility and C2 intra-theater via Sea Basing or Intermediate Staging Base

- No logistics buffer to function as fulfillment center to maximize throughput at a Sea Base or other distributed logistic network

- Supply chain vulnerability that degrades force protection

2.2 Evaluating Identified Capability Gaps for Resolution

The SM21 JALTD will employ the use of multiple stages of screening to determine the appropriate requirements and concepts associated with the capability gaps that should be selected for development. The screening processes that will be employed constitute gates through which sets of requirements and associated concepts must pass before advancing on to the next stage in the development process. This concept was popularized in the stage-gate product innovation process. This approach will be developed along side a "time box" development approach potentially under the advisement of DISA to incrementally develop, integrate and demonstrate objective capabilities to fulfill the validated demonstration requirements. Wherever feasible and operationally validated, the SM21 JALTD will adapt, reuse and/or leverage the results of other logistics decision tools to provide economies of scale and increase interoperability within the suite of military and commercial logistics systems.

The SM21 JALTD program goal of making distribution logistics information more accurate and available to support decision processes will require both technology insertion and process improvement.

The following table associates the identified capability gaps with the SM21 Integrated Product Teams and associated task structures that are best suited to resolve the gaps. Although not specifically mentioned in the table below, the PMP IPT supports all of the tasks identified by providing background analysis and project management support.

Table 1 – Capability Gaps and Associated Tasks

Capability Gap	Primary IPT(s)	Associated Project(s)
Hierarchical, stove-piped logistics chains which cannot support distributed, adaptive operations	JLETT	CLIN 0019 – Sea Base Logistics. This task will support the design of an integrated logistics chain through the JPPSP to the sea-base or intermediate staging base (ISB). The integrated distribution design will support distributed and adaptive operations.

Capability Gap	Primary IPT(s)	Associated Project(s)
Existing logistics information architecture that is focused on the port-to-port and not the end-to-end distribution process	Info Fusion	CLIN 0009 Data Communication Standard; CLIN 0012 IT Data Network; CLIN 0013 Web Portal
The lack of a single platform to track in-transit visibility at ground level and for input to higher level enterprise architecture for decision support	Info Fusion	CLIN 0009 Data Communication Standard; CLIN 0012 IT Data Network; CLIN 0013 Web Portal
The lack of dynamic network visibility to locate and determine status of assets across network	Info Fusion	CLIN 0009 Data Communication Standard; CLIN 0012 IT Data Network; CLIN 0013 Web Portal
DOD Automated Identification technology (AIT) use that is sub-optimized through inadequate business processes	JPPSP and Info Fusion	CLIN 0010 Wireless; CLIN 0008 Terminal Specification
Current marshaling and staging procedures at US Strategic Ports that add disruptions to commercial operations	JPPSP-JLETT	CLIN 0006 Rail Network; CLIN 0008 Terminal Specification; CLIN 0011 ICODES CLIN 0016 SCASN Model
Limited synchronization of vessel stowing at strategic ports, inter-theater movement, and "arrival to flow" through Reception, Staging, and Onward Movement at Sea Ports of Debarkation (SPOD)	JPPSP-JLETT	CLIN 0006 Rail Network; CLIN 0008 Terminal Specification; CLIN 0015 Toolkit CLIN 0016 SCASN Model
Limited use of combining asset identification technology with information flow monitoring transportation equipment movement	Info Fusion-JPPSP	CLIN 0009 Data Communication Standard; CLIN 0010 Wireless; CLIN 0008 Terminal Specification

Capability Gap	Primary IPT(s)	Associated Project(s)
No wide area network information architecture template that can be rapidly deployed to extend asset and shipment visibility and C2 intra-theater via Sea Basing or Intermediate Staging Base	Info Fusion-JLETT-JPPSP	CLIN 0013 Web Portal; CLIN 0015 Toolkit; CLIN 0019 Sea Based Logistics CLIN 0008 Terminal Specification
No logistics buffer to function as fulfillment center to maximize throughput at a Sea Base or other distributed logistic network	JLETT	CLIN 0019 Sea Based Logistics
Supply chain vulnerability that degrades force protection	JPPSP	CLIN 0017 Force Protection

2.3 Potential Initial Experimentation Efforts

Several technologies were identified in the current program year proposal and programmed for procurement. These technologies will be developed for initial experimentation during Calendar Year 2007. The technology under consideration for experimentation is outlined below:

- Class VIII Medical Supplies or Class IX Repair Parts Tracking employing:
  - A composite, modular container system with integrated condition and position monitoring technology
- Nested shipment tracking technologies including sensors to monitor:
  - Container seals
  - Shock
  - Temperature
  - Other as determined during analysis
- Railcar to railcar active tracking tag development with sensor integration
- Use of advanced video surveillance and tracking systems for terminal management and security applications
- Extension of the DoD Ship-loading system – the Integrated Computerized Deployment System (ICODES) for use in the dynamic re-planning during military force deployments.

As introduced in paragraph 2.2 above, the use of multiple stages of screening will be employed to determine, which technology is best suited to fill the identified capability gaps in Table 1. The technology with the best fit will be selected for initial experimentation. The screening processes will constitute a series of gates through which technology and associated concepts must pass before advancing on to the next experimentation stage.

SECTION 3

3.0 Technologies, Processes, and Technical Approach

3.1 Emerging and Advanced Technologies

Emerging and mature advanced technologies and enhanced operational processes will be used to varying degrees in the following candidate elements of the SM21 JALTD:

- Decision Support Tools (DST) to enable dynamic re-planning of force deployments, military sustainment, and commercial shipments
- Data integration,
- Enhanced asset tracking to support dynamic re-planning,
- Agile and efficient transportation terminal concepts.

While several advanced technologies have been identified, selection of the most appropriate aspects of enabling and advanced technologies for inclusion in the JPPSP will be identified during the remainder of the 2006 - 2007 through the use of trade studies and experimentation as outlined in Section 5 - Systems Engineering Plan.

In support of the decision support tool development, the SM21 JALTD will use advanced commercial and military systems associated with terminal operations and multi-modal shipment tracking will be employed. Selected military systems such as the Integrated Computerized Deployment System (ICODES), the Joint Logistics Toolkit, and TRANSWAY will be employed to assist in providing asset visibility, operational situation awareness, and commander's intent.

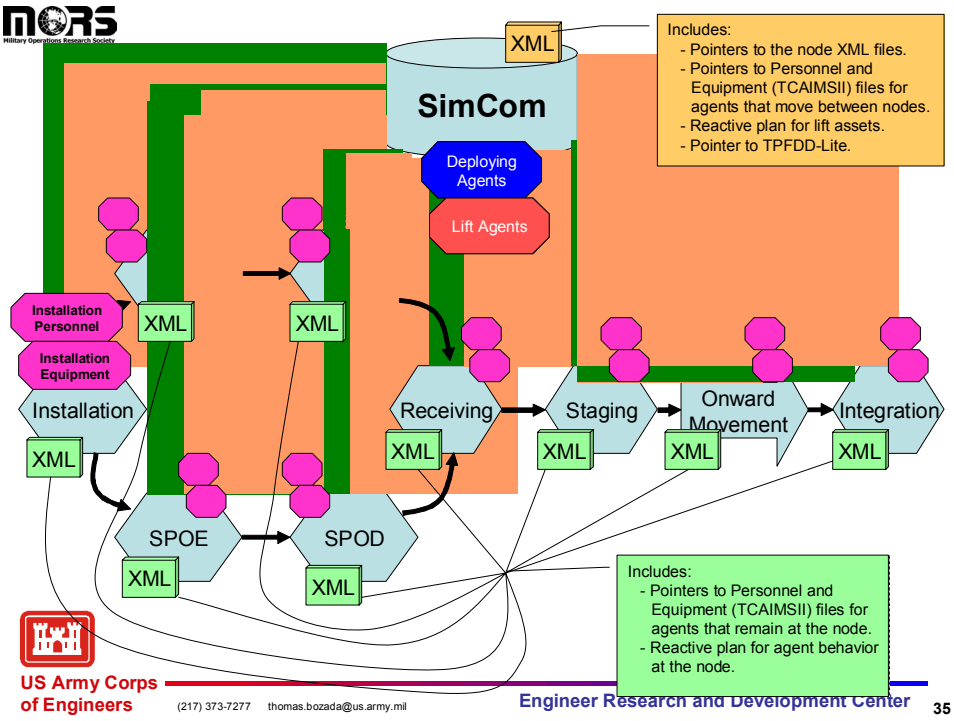
An overview of the technology under consideration for the initial SM21 JALTD capability demonstration is provided below and in paragraph 4.3 – Development Strategy:

- ICODES provides for a single, cross-service planning and execution system for ship loading and stowage. It is engineered to provide users with intelligent decision-support during administrative, preposition, and humanitarian assistance operations. ICODES integrates multiple expert programs, knowledge bases, and graphical user interfaces within a computer-based distributed cooperative operational environment. The bulk of DoD unit equipment and re-supply cargo is moved through designated water terminals worldwide for on-load and transit via water-bound vessels. These ocean terminals support the Defense Transportation System (DTS) in the movement of DoD cargo, privately owned vehicles, household goods belonging to members of the armed forces and civilian employees, and unit equipment. Building on ICODES will support development of an in-transit dynamic re-planning capability.
- Fort Future agent-based discrete-event simulation of end-to-end deployments as depicted in Figure 1 below. The Fort Future program is a research program designed to produce capabilities critical to making strategic and operational distribution decisions by visualizing results of many different distribution scenarios. Fort Future research and development is being conducted by the U.S. Army Engineer Research and Development

Center (ERDC) in support of the Office of the Assistant Chief of Staff for Installation Management (OACSIM). Fort Future has created a system-of-systems that unites existing and new computer models to form a virtual installation. These efforts will support the dynamic re-planning of force deployment operations.

- The JPPSP Web Portal/SM21 JALTD Web Portal will be designed to support the operations associated with the Victorville facility. The portal will provide a highly tailored interface to enable military transportation workers and ship stow planners to communicate and collaborate effectively. The portal is a highly tailored interface that assist will assist the work of transportation specialists by supporting their "cognitive processes" and letting them have a common "view" of the aspects of the situation they are concerned with in performing their functions. Consideration will be given to the potential use of advanced graphics technology to overcome the often cited shortcomings of Geographic Information Systems (GIS). GIS provides a way of compiling and presenting electronic data in an ordered manner -- for instance, environmental, social and physical data can be overlaid on presentation maps. But GIS programs can also be considered cumbersome. A major drawback is that they develop vast numbers of individual maps without providing a look at the whole picture. The "cumbersome" aspects of GIS are primarily associated with its technical sophistication. GIS is also not easily employed with intelligent agent technology, which presents a particular challenge for SM21. The usability of GIS for the SM21 JALTD Web Portal will be examined and alternative graphics applications will be reviewed as a part of the systems engineering effort. The JPPSP COP will also employ advance data integration (translation) technology and stakeholder system "on-boarding" processes.

Figure 1 - Fort Future Agent-Based Discrete-Event Simulation of End-to-End Deployments



3.2 The Technical Approach

The SM21 JALTD intends to provide asset and shipment visibility and decision support tools. The objective is to provide distribution managers and operational logisticians the tools necessary to support force deployment and distribution: planning, execution, and in-transit dynamic re-planning for the full spectrum of operations through the application of mature commercial and government software packages. Therefore from the technical perspective the SM21 JALTD will be focused primarily on systems engineering, integration, and application, with minimal software development. To help achieve these goals, it will be necessary to perform an Architecture Design Review early in the program to ensure the SM21 approach is on a path for integration with the appropriate commercial and military enterprise resource planning (ERP) systems that are associated with the Victorville facility. There are three architectural areas, which will be addressed, in the technical development of the SM21 JALTD capability--the DoD Joint logistics systems and service systems; the commercial shipper logistics information systems; and the commercial transportation mode operator support systems. Each of these areas has unique characteristics and will require specific attention to define the interface requirements within those domains.

The objectives of the SM21 JALTD can be mapped into the following four technical areas:

Decision Support Tools: The objective of this area is to identify the logistics data and decision support tools necessary to plan, monitor and control the deployed or deploying force logistical mission. It identifies and integrates tools to support both military and commercial distribution efforts from end-to-end in the US distribution network with interfaces to theater and overseas locations for military and commercial shipments.

Security Architecture: The objective of this area is to provide the security controls and information assurance protocols required to protect the system and logistical data contained within the system. It will include the ability for military and commercial stakeholders to define security and interchange characteristics of data provided from their systems or sources as it flows into the SM21 JALTD system. Security definition tools are needed to specify the security constraints controlling what data leaves military and commercial systems, are shared in the SM21 environment, and what data is allowed to flow back into military and commercial logistics systems.

Network Infrastructure: The objective of this area is to engineer the network architecture and components necessary to support the operational requirements developed for the SM21 system. It will be developed in close coordination with the security requirements developed in the Security Definition area. It will include basic infrastructure support for collaboration tools as defined by the DoD.

Stakeholder Interface Definition: The objective of this area is to rigorously define a set of capabilities to facilitate the flow of military and commercial logistics data into SM21 and between the different architectural partitions. This area also would deal with such concepts of determining technological “tiers” of capability and expressing requirements for differing levels of capability to interact in the SM21 information system. It also includes defining a Data Dissemination Environment (DDE) to define the integrated data schema at the military and commercial level, forming the SM21 data model and integrating it with the distribution decision support tools. This effort will leverage those of the Distribution Functional Working Group

(DWFG) at USTRANSCOM, which is currently evaluating a wide spectrum of candidate platforms.

3.3 Measures of Effectiveness/Performance

The operational parameters by which the SM21 JALTD commercial and military utility will be assessed during the JALTD period will include the degree to which SM21-developed capabilities achieve the following:

- Improve access to accurate and relevant force deployment, sustainment distribution, and commercial distribution logistics information,
- Provide accurate and relevant military and commercial distribution logistics information to a broader array of stakeholders through the web enabled environment,
- Improve user distribution logistics situation awareness and execution decision making ability,
- Improve the ability to collaborate on distribution logistics decision, planning, dynamic re-planning and execution of selected tasks.

In evaluating the military utility of the SM21 JALTD capabilities, three interrelated elements will be employed:

- Critical Operational Issues (COI): These are high-level questions about accomplishment of the military and commercial tasks/demonstration objectives as well as systems operational tasks, essential capabilities, risks and uncertainties. COI do not have direct evaluation (parameters, objectives, or thresholds); rather, they ask the question that leads to the identification of direct evaluation criteria that have finite metrics.
- Measures of Effectiveness (MoE): A measure of the operational success that must be closely related to the objective of the military or commercial operation to be evaluated. A meaningful MoE must be quantifiable, objective wherever possible, and measure the degree to which the real objective is achieved. MoE measure task accomplishment.
- Measures of Performance (MoP): Reflects systems technical capabilities and may be expressed in systems engineering terms such as speed, payload, range, time on station, survivability, or other distinctly quantifiable performance features. MoP measure attributes needed for the task.

The degree to which each of the SM21 JALTD related MoE and MoP can be measured at each annual assessment event will vary depending on the type of venue (i.e., force deployment exercise, experiment, capability demonstration, etc.), (military or commercial application), and the specific processes and data inputs/sources being used or modeled.

Prior to each demonstration or large scale experiment, the SM21 JALTD Technical Committee will decompose each of the above MoE/MoP in greater detail to tailor them to the specific demonstration. Table 3 provides a point of departure for MoE/MoP tailoring of use.

Table 2 - SM21 JALTD Effectiveness and Performance Metrics

Critical Operational Issue	Measures of Effectiveness	Measures of Performance
Can military operational logisticians (as required and authorized) have access to relevant force deployment and sustainment distribution information/data in order to make decisions that directly improve the deployment and sustainment flow?	Provides accurate visibility of installation and US transportation infrastructure in a common workspace for authorized users with 90 % reliability. Provides planned and executing deployment information related to the JPPSP for forces and/or materiel for a 72-hour future window in a common workspace with 95% reliability. Provides accurate in-transit visibility of material, to the discrete identifier level of data, from the point of origin (as defined during the "on-boarding" process) to defined logistics release point in a common workspace for authorized users with 95 % reliability.	The data representing the transportation infrastructure is refreshed on a near real time basis. Refresh period will be refined after the initial capability demonstration. The data capture mechanisms for military force deployment and distribution definition and transmittal permit creation and transmittal of requirements in a manner synchronized with the military and commercial operations. The data capture methods for military and commercial in-transit visibility provide timely refresh of data in a manner that fully supports the MoE.
Is the confidentiality of sensitive military and proprietary commercial data maintained at all level of users in the resultant system?	Provides information visibility to authorized viewers in a common workspace with 98 percent reliability.	There is no exposure of designated data elements to non-authorized users.
Does the information connectivity within a military or commercial entity provide logistics information sharing in a manner that enhances distribution logistics interoperability?	Enables a capability that permits authorized users to transmit captured data to the military or commercial logistics interface definition within 5 minutes of system access. Enables a capability to provide accurate, refreshed, and relevant information to the defined military or user population in a common workspace with over 95% availability.	All the elements of transmitted data complete the transmission cycle within time parameters and are readable by the receiving system. The data elements employed to create decision-making information are updated with enough periodicity to ensure accuracy of information.

Critical Operational Issue	Measures of Effectiveness	Measures of Performance
Do the data capture, data aggregation and data to information transformation methods provide the appropriate decision support for all authorized commercial and military users?	Receives transmitted data from respective military and commercial logistics systems and is capable of accurately performing the requisite data translation and aggregation to generate defined logistics information with 95 percent reliability.	Received data is capable of being transformed into relevant information without data format or content errors.

3.4 Technical Risk Assessment

Risk assessment, identification, and mitigation are elements of the SM21 JALTD. Since the JALTD is a very aggressive program, risk is a significant concern. Delays in the 2005 - 2006 contracting process resulted in the significant loss of momentum during the initial phases of the program and have resulted in the loss of some project members with significant domain knowledge. Based on this situation several steps were taken. First the initial risk assessment outlined below was performed while a concurrent effort was under taken to develop a more sophisticated risk assessment process which is documented at Appendix A to this Annex. This new risk assessment process will be used during the next risk assessment evaluation due for completion during November 2006.

From a current technical risk perspective, risk is present for the SM21 JALTD as follows:

Scope: The issue involves adequacy of resources, technology and time to address the defined range and depth of system definition and development requirements.

SM21 Infrastructure at Victorville: The issue involves the presence, availability and adequacy of the required SM21 JALTD infrastructure (rail spur connecting the facility with the Class I main line) and communications. The issue also involves the required information management infrastructure and data integration support for data collection, information generation and information transmission requirements of SM21 JALTD and the dissemination of relevant information for decision support.

Military and Commercial Systems Interface: The risk involves the ability to rapidly access and integrate data from disparate commercial and military logistics systems into a common SM21 JALTD logistics data environment.

Security: The risk is generated from the need to maintain multiple levels of data separation driven by commercial propriety and military data sensitivity in an environment designed to integrate data to generate relevant information.

The following methods and strategies will be used to mitigate these risks:

Scope: Through a user driven requirements process and continuous engagement by the SM21 Technical Committee, the demonstration features of the SM21 JALTD will be defined, refined, and limited to fit within the resource, time and technology base of the effort.

SM21 Infrastructure: Several existing networks on Victorville satisfy this need during force deployment and sustainment distribution operations.

Military and Commercial Systems Interface: This issue should be resolved through a series of software driven solutions i.e. XML tagging, measurement and data translation modules, data capture methods – all supported by existing commercial software. The integration software and practices will be supported by an advanced stakeholder system on-boarding business process.

Security: Risk mitigation is planned through the use of a combination of hardware and software means i.e. network security tools, security audits, and data guards that will be drafted during the program year.

Several inherent aspects of SM21 JALTD also contribute to risk mitigation:

- The SM21 design and development will be consistent with the evolving net-centric architecture and the close adherence to the Federal Information Security Management Act (FISMA).
- Wherever possible and feasible, Government Off-the-Shelf (GOTS) or Commercial Off-the-Shelf (COTS) technologies will be employed to leverage design and technology maturity.
- The developed capability will be interoperable with existing military and commercial approved architectures.

The below table reflects the current technical risk assessments of the SM21 JALTD elements.

Table 3 – SM21 JALTD Technical Risk Assessment

Technical Risk Area	Rating	Mitigation
Information Security between Military and Commercial Partners	Low – Medium	Employ data guards to protect data sovereignty
Adequacy and Capacity of Network Infrastructure for Military and Commercial Workload	Low	Increase capacity of network as required after completion of a second iteration of the system engineering effort
Access to Network by All Users	Low – Medium	Extend web access to all authorized users through a defined role based access process.
Incompatible Data Elements for Units of Measure and Other requirements	Medium	Employ translator and data integration mapping processes for EDI and AEI.

Technical Risk Area	Rating	Mitigation
Incompatible Data Elements due to Lexicon	Low	Employ Lexicon translator

3.5 Affordability

The scoping of the demonstration requirements from the broad spectrum of distribution logistics to some finitely defined, well understood transportation and in transit visibility issues significantly enhances the affordability of the SM21 JALTD. The majority of the SM21 JALTD capabilities will be process or software-based and designed to leverage existing and planned commercial and military systems. During the demonstration and assessment phases of the JALTD, minimal new equipment is anticipated, although existing software may need to be modified or integrated in a better design. The new development cost of the decision support tools within or integrated with existing software may be less than new development, as these tools will be potentially shared from existing applications. While a low to medium level of technical risk exists for information security between military and commercial partners, these challenges should be resolvable within budgeted resources.

3.6 Interoperability

All aspects of the SM21 JALTD, from requirements definition through prototype and fielding, will be conducted in a joint military – dual use setting with the goal of common web-based access to all tools through the SM21 Web Portal. While all products will be interoperable, there will also be sufficient agility in the selected programs to allow adaptation of these common products to other distribution nodes such as at a sea-base or intermediate staging base (ISB).

3.7 Equipment

During the development and demonstration phases, minimal new equipment will be required at the Victorville distribution node. Required servers, monitors, RFID and camera technology have been funded as a part of the initial SM21 Fiscal Year program although some additional procurements will be needed for subsequent years. Currently, the data communications for SM21 JALTD is planned to occur on existing networks; this minimizes the potential need for development of a separate SM21 JALTD network for data connectivity. During the preparation for the SM21 JALTD initial assessment, scheduled for the spring of 2007, the need for additional hardware and software will be assessed.

3.8 Annual Assessments and Demonstrations

The SM21 JALTD Technical Committee will coordinate the conduct of assessments of SM21 capabilities with stakeholders designated as potential SM21 users and stakeholders. Scheduled demonstrations will assess military utility during scheduled military deployments or training exercises. Other commercial and military demonstration venues may also be added if deemed appropriate. In addition to military and commercial use assessments, assessments will be performed on the SM21 capabilities to evaluate the following: Architecture Interoperability / Integration; Information Assurance / Integration; Bandwidth Requirements, and System

Scalability. These assessments will be used to develop transition options and recommend a transition strategy and transition course of action.

Selection criteria for a particular demonstration, experiment, or exercise (events) will include:

- Suitability of the event to demonstrate and assess the military and/or commercial utility of SM21 capabilities and support collection of data to guide further improvement;
- Feasibility of the availability of SM21 JALTD capabilities within the scheduled exercise milestones; and,
- Acceptability by the military or commercial authorities of the SM21 JALTD assessment event to complement established exercise objectives.

These three criteria form the foundation for the process supporting SM21 JALTD system development, demonstration, and assessment.

Based on the criteria above, a request for sponsorship was made to USTRANSCOM to coordinate the selection of the best suited force deployment or scheduled military exercise through the Port of Tacoma for the initial SM21 JALTD annual assessment during early 2007 as outlined below. Additionally, a second year assessment has been tentatively planned and is also overviewed below:

- 1st Year Limited Capability for Force Deployment Demonstration: The SM21 JALTD is currently cooperating with the Office of Naval Research (ONR) and Center for the Commercial Deployment of Transportation Technologies (CCDoTT) managed Agile Port System project for a first year limited force deployment capability demonstration. The USTRANSCOM will conduct a series of joint planning sessions with the APS and SM21 JALTD programs to identify a possible force deployment or military exercise to enable the demonstration. The primary capability focus of this effort will be partial fulfillment of the strategic deployment objective, with lesser and related focus on the other demonstration objectives. The ability to create, transmit and use a “backward extended" ICODES strategic sealift ship loading and movement plan for strategic deployment planning and execution has been identified as a key product of this demonstration. A more complete description of the demonstration is provided further below in paragraph 3.10.
- 2d Year Event: Under early consideration, leveraging a Joint Forces Command (JFCOM) identified military exercise, the second annual assessment event will have a primary capability focus on the fulfillment of the force deployment in-transit visibility objective, with lesser and related focus on other demonstration objectives to be determined by the Technical Committee. The ability to track and dynamically re-plan in-transit shipments are the key capabilities sought in this demonstration.

Before each annual assessment, the following operational planning and preparation processes will be completed:

- Identification of Lessons Learned from Previous Assessments for integration into the foundation of the next demonstration.

- Identification and revalidation of operational capabilities to be demonstrated.
- Identification, refinement and validation of the MOE and MOP to be employed in the accompanying military or commercial utility assessment.
- Integration of the capabilities to be demonstrated and military and commercial utility assessment plans into a single operational demonstration plan.
- Rehearsal of the operational demonstration.

As a complementary effort, mini-demonstrations and experiments associated with the SM21 JALTD will be conducted with informal assessments.

3.9 First Year Military Demonstration Objectives

The initial joint SM21 JALTD-APS demonstration planning efforts have resulted in the identification of several objectives associated with the deployment of a Brigade Combat Team – Unit of Action as outlined below:

- Evaluate the theoretical benefits of an APS combined with the capabilities of the SM21 JALTD - specifically:
  - The ability of a marine terminal to accommodate military load out operations while minimizing disruption to commercial operations
  - Minimize the amount of terminal property required during ship loading operations by reducing total acreage required on or in the immediate vicinity of the terminal to two acres or less[6]
  - Conduct military unit deployments through a commercial terminal between scheduled container ship unloading and loading operations
  - Provide the ability to plan, track, and dynamically re-plan force deployments from a Power Projection Platform (PPP), more commonly referred to as a military installation, to a strategic port. The strategic port selected for the demonstration is the Port of Tacoma.

The overarching objectives are to construct and demonstrate revised force deployment processes that are supported by an extended ICODES software application. The ICODES extensions are designed to enable dynamic re-planning of the force deployment process from the unit home station through the strategic port.

3.10 Overview of the Demonstration Scenario

The demonstration scenario begins when the Joint Force Requirements Generator (JFRG II) passes the force deployment requirement to Transportation Coordinators' Automated Information for Movement System II (TC-AIMS II). As a revised process, the data transfer from TC-AIMS II to ICODES would be made as soon as possible to develop the initial ship stowage plan. The following processes would be implemented:

[6] The current normal requirement is 20 to 30 acres.

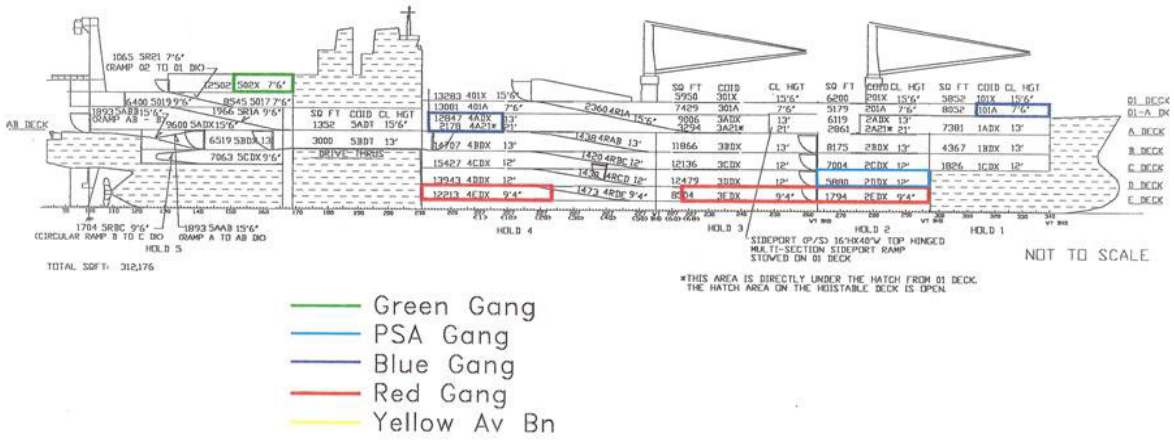
- Based on the ICODES stow plan, employ a ship-loading model to develop the optimized equipment loading sequence (maximize the number of holds/decks loaded concurrently),
- Based on ship stow and loading plans, use ICODES to:
  - Template marshalling and staging areas from the PPP to the strategic port and provide the basis for the sequenced movement to the port,
  - Support labor and movement to port planning based on phased loading sequence (see Figure 2),
  - Dynamically re-plan ship stow and the sequenced load plans
- Employ revised convoy and rail[7] movement planning and movement procedures – based on reverse planning from the ship stow/load plan as outlined above.
- Utilize the full capabilities of the Fort Lewis Deployment Facility
  - A demonstration goal is to process a brigade combat team through the Fort Lewis Deployment Support Facility in two days or less for movement to the Port of Tacoma.
- Utilize TC-AIMS II and evaluate an interface with ICODES for early and continuous re-planning of the deployment process from the PPP to the final ship stow location. It should be noted that before this process can be more fully developed, a joint planning session with the TC-AIMS II program office and the ICODES program manager would be required.
- Improve unit equipment tracking through more complete integration of EDI and RFID shipment tracking capabilities.
- Provide an opportunity for identifying additional process improvement and system infrastructure improvements through this Functional Area Analysis.

[7] As a rule of thumb, units over 400 miles from the port would move to the port complex via rail and units within a 400 mile radius of the port would convoy.

Figure 2 – Ship Load Planning

1. Ship-loading pattern established by ICODES stow plan and loading model results
2. Each stevedore work period is planned in advance so the correct gang structure is available at the start of each time period as depicted below
3. The maximum number of decks and holds are loaded concurrently through each point of entry to include lift points
4. Load plan is used to reverse plan the sequenced and timed movement of each unit from the unit motor pool to the port of embarkation
5. ICODES will be used to develop all marshalling area and staging area templates

Day 1 - Loading Period One: 0700 -1200



While the distance from Fort Lewis to the Port of Tacoma is only 15 miles, the demonstration team has the ability to integrate or employ various tracking technologies for both convoy and rail movements. The rail tracking data capabilities would be required for deployment of force modules that are more than 400 miles from the Port of Tacoma. Although not normally used for PNW deployments by the 833rd Transportation Battalion, the use of the Intelligent Road/Rail Information Server (IRRIS) is being planned to provide a visual common operating picture. EDI (Car Location) messages are currently provided to IRRIS by the SDDC Rail Fleet Management System operated by IntelliTrans. The rail tracking EDI, or Car Location Messages, could also be integrated with the Savi SmartChain Platform and TC-AIMS II if there was a requirement for a rail deployment.

A joint APS and SM21 JALTD demonstration team and Savi site survey will be completed as soon as clearance is given and the unit being deployed is selected. The site survey will identify existing RFID infrastructure and an assessment will be made if additional temporary installation requirements for the hardware and software components of the RFID based tracking system are appropriate and feasible. To supplement the RFID tracking system, there is a potential for limited testing of a GPS based satellite tracking technology to simulate the eventual

incorporation of the Movement Tracking System within the United States. A configuration under evaluation for the asset tracking system incorporates a SmartChain Platform instance and up to four Savi Site Managers to integrate satellite and RFID tracking data. The tracking data would be supplied by the platform to ICODES to enable dynamic ship stow, load, and unit movement planning. Asset tracking will start at the PPP marshalling area and will continue until the assets enter the strategic sealift or commercial ship for loading. A limited demonstration is being planned for tracking unit equipment via RFID to the final ship stow location. A final decision on this limited on-ship tracking capability demonstration will be made during the joint USTRANSCOM and APS - SM 21 JALTD program planning process.

As the planned common visual operating picture, IRRIS will receive direct data feeds form the SmartChain Platform and potentially ICODES. Additionally, IRRIS will incorporate route traffic cameras with additional camera augmentation by the demonstration team for more complete visual management of the deployment process.

While ICODES will support the ship stow plan; ship loading plan; and staging, marshalling, and movement plans; the Engineer Research and Development Center, Agent Based Discrete-Event Simulation of End-to-End Deployments is being considered to match required resources with the movement and loading plans developed on a dynamic basis.

3.11 Simulation

3.11.1 Introduction

The SM 21 JALTD program will use analysis, modeling, and simulation to:

- Support the design of the JPPSP at Victorville
- Investigate those logistics and transportation concepts that will enable the facility to be a commercially successful joint use facility and
- Evaluate capability demonstrations planned as part of the SM21 JALTD

The scope of these efforts will be determined by the questions that must be answered to design the facility and prove its commercial viability as well as its military usefulness in both surge deployment and sustainment. Many of these questions will be answered will be answered by the development of business and operational hypotheses for both commercial and military operations. The development of these hypotheses will occur during the development of the Southern California Agile Supply Network (SCASN) model node-arc network structure.

The current SM21 JALTD program includes the development of two models. The first model is for the multi-model terminal development and the second model will be developed incrementally and will ultimately become the SCASN model. The models will be developed so that they can provide input to the other model. At the end of the current project year, the multi-modal terminal model will be offered to Stirling and the SCLA as a support tool for the development of the Victorville transportation infrastructure. Initial discussions on the use of the model for facility development have been held.

The focus in the first year of the SM 21 project will be on meeting the driving requirements. From the point of view of modeling and simulation, these are:

1. Surge deployment,
2. Surge sustainment, and
3. Agile port and regional network based operational concepts that accommodate anticipated container traffic growth using a combination of synchronized on-dock rail and truck processing at the port. The concept includes maximum utilization of the existing regional surface transportation network and planned improvements integrated with necessary staging, buffering, mega-switching, and additional processing at an inland multimodal hub facility.

The first two items are important to meet the military requirements of the JPPSP. The third item is necessary because the Victorville Facility that will host the JPPSP must be a commercially viable dual-use platform because there will be an insufficient volume of military use to justify building and operating facility. It appears that the best way to justify building the Victorville Facility is to pair it with operations at POLA and POLB to implement new operational concepts that will result in better throughput in the ports, more utilization of rail, and less reliance on diesel-fueled trucks for goods movement in the Southern California region.

The minimum modeling capabilities that must be developed during the first year of the project must enable the investigation of three driving requirements. The model development efforts must provide:

1. A fine grained port container yard modeling capability that applies to real and hypothetical container yards operations at POLA and POLB,
2. An initial regional network modeling capability of the transfer trains using block-swapping and other operational techniques between the ports and the Victorville Facility against the backdrop of normal rail traffic in the Southern California region,
3. A fine grained modeling capability that applies to hypothetical multi-modal yards and associated switching facilities at the Victorville Facility.

The first and third of these modeling requirements are necessary to prove that new concepts such as agile and efficient port operations will provide the projected benefits. The developed models must be fine-grained enough to discern the differences between old and new operational concepts as well as differences in the quantities and characteristics of equipment. The second model is necessary to determine the impacts on other commercial and passenger traffic in southern California if any of the three scenarios that are driving requirements occur. These three modeling capabilities must be integrated and form the basis of a simulation of those aspects of goods movement in southern California that are most directly involved in the three driving scenarios. In addition, analysis will be performed using elements of the models to assist in defining requirements especially those related to the sizing of facilities.

3.11.2 The scope of modeling and simulation

How models and the simulations based on them are developed depends upon the questions that

the models and simulations are expected to answer. Before the models can fully support SM21, business and operational hypotheses must be developed to guide model development, data collection, and guide the responses to the first year modeling questions outlined below. The SM 21 project will initially develop a core set of models and simulations that will be expanded later in the project to include additional features for answering a wider variety of questions. The questions expected to be answered by modeling and simulation as well as questions that determine what worked is to be modeled and/or simulated both during the first year of the project and in subsequent years are listed in the following subparagraphs.

3.11.3 First-year modeling questions

How many container terminals and ships must be modeled?

1. Is it sufficient to choose a single container terminal at either POLA or POLB or is it necessary to model all of the container terminals in both ports?
2. Is it sufficient to model the unloading of containers from a single container ship and the composition and dispatch of the trains resulting from those containers or is it necessary to model the unloading of multiple ships?

How should port container yards be modeled?

3. What pieces of container yard equipment and container yard locations need to be modeled?
4. To what fidelity must port container yards be modeled?
5. How should port container yard models be validated?
6. What port container yard business process alternatives should be investigated?
7. What measures of effectiveness should be applied to container yard operations?
8. Should models and simulations be able to determine either bottlenecks or excess capacity due to the quantity of equipment and facilities and/or the business practices in port container yard operations?

Railroad modeling

9. How should the interface between the container yard and PHL be modeled?
10. How should the PHL rail system be modeled?
11. How should multimodal train traffic between the interchange point with PHL and Victorville be modeled?
12. How should background traffic arising from other commercial railroad traffic as well as passenger traffic be considered in models and simulations?
13. How should the scheduling of trains from the ports by the Class I railroads be modeled?
14. Should the models and simulations be able to determine the impact caused by surge military deployment and sustainment or by the adoption of new port operational concepts on other railroad traffic in the Southern California region?

Military transport ship loading

15. How should the unloading of military cargo from trains and the loading and stowing of that cargo on military transport ships be modeled?
16. What the measures of effectiveness should be used for military cargo trans-loading from rail to ship?
17. What port facilities and personnel must be modeled to effectively model and simulate military cargo trans-loading from rail to ship?

How should the Victorville Facility be modeled?

18. What elements of the Victorville Facility equipment need to be modeled?
19. To what fidelity must the Victorville Facility be modeled?
20. How should the Victorville Facility models be validated?
21. What Victorville Facility business process alternatives should be investigated?
22. What measures of effectiveness should be applied to the Victorville Facility operations?
23. Should models and simulations be able to size (that is, determine either bottlenecks or excess capacity due to the quantity of equipment and facilities and/or the business practices) in Victorville Facility operations?
24. How should the interface between the Victorville Facility and the Class I railroads be modeled?
25. How should the scheduling of trains from the Victorville Facility to the ports by the Class I railroads be modeled?
26. What are the purposes of the Victorville Facility model and simulation?

Possible purposes of the Victorville Facility model and simulation include:

a. Evaluate a new technologies and operational concepts for the movement of goods within Southern California.
b. Determine whether concepts such as agile and efficient ports are cost effective in improving the throughput of container traffic through Southern California ports. (The Victorville Facility would work as an Inland Port in conjunction with operations at the ports themselves in implementing agile and efficient port concepts.)
c. Provide a tool for evaluating specific investments in Southern California regional goods movement infrastructure, including the investment in Victorville Facility itself.
d. Have sufficient fidelity so the large-scale demonstrations need not be conducted because new concepts can be validated by modeling and simulation alone.

Meta-issues applying to multiple areas:

27. What policies and practices (both existing and potential) of various businesses and organizations need to be modeled?

Possible policies and practices include:

a. Labor practices
b. Agreements among organizations (such as an agreement between a shipping line and a railroad to provide a single price to ship a container from a source such as Singapore to a destination such as Logistics Park Chicago).
c. Government regulations
d. Business rules of railroads and truck lines

28. How should scenarios and "data sets" for hypothetical situations be created and managed?
29. What "disruptions" should be modeled in surge deployment scenarios?
30. Can ship stow planning and loading "absorb" certain disruptions without re-planning? That is, can those disruptions that must be mitigated by actions at the Victorville Facility be separated from those that require no mitigation?
31. Which disruptions in surge deployment scenarios can be mitigated by actions at the port? (For example, if the order of two rail cars in the same cut of cars is switched, the cargo could be put back into the correct loading order at the port.)
32. How should the impact of a surge deployment/surge sustainment on commercial goods movement be measured?

3.11.4 Future year questions

Once the initial models and simulations are developed, the SM 21 project will extend them into a Southern California Agile Supply Network model and simulation (SCASN). In the scope of this model and the accompanying simulation will be determined by the questions that need to be answered. These questions include:

33. What are the purposes of the SCASN model?

Possible purposes include:

a. Evaluate a new technologies and operational concepts for the movement of goods within Southern California.
b. Determine whether concepts such as agile and efficient ports are cost effective in improving the throughput of container traffic from Southern California ports.
c. Evaluate the cost-effectiveness of constructing an inland port at the SCLA in Victorville that can work in partnership with the San Pedro Bay area ports.
d. Provide a tool for evaluating how the federal government might best assist the Southern California region in alleviating the substantial local burdens caused by goods movement through the region to other states.
e. Provide a complete model capable of evaluating all goods movement alternatives through Southern California including by alternate means of transportation such as truck, rail, and air.
f. Model the complete regional goods movement system including the Southern California area: seaports, ports of entry from Mexico, commercial airports, rail Intermodal yards, and the various trucking companies, independent truck operators, trans-loading facilities, distribution centers, warehouses, manufacturing, and retailing

venues.

g. Provide a tool for evaluating specific investments in Southern California regional goods movement infrastructure.
h. Have sufficient fidelity so the large-scale demonstrations need not be conducted because new concepts can be validated by modeling and simulation alone.
i. Determine the effects of various goods movement strategies on air pollution.
j. Determine the effects of various goods movement strategies on environmental justice.
k. Determine the economic impacts of various goods movement strategies.
l. Determine the political impacts of various goods movement strategies.

34. Are there certain specific projects and technologies that SCASN should be able to evaluate?

The projects and technologies include:

a agile and efficient port concepts,
b shuttle trains to reduce the number of containers trucked out of the San Pedro Bay ports,
c increased utilization of on dock rail yards to reduce containers that are trucked from the ports,
d addition of labor and were changes in labor practices at San Pedro Bay area ports,
e the addition of truck only lanes and/or truck climbing lanes to Southern California highways and freeways,
f port infrastructure projects to improve rail operations,
g a new intermodal facility in Victorville,
h new freight rail capacity,
i the Southern California International Gateway (SCIG), and
j the impact of surge deployment and sustainment on the commercial goods movement within Southern California

SECTION 4

4.0 Programmatic and Organizational Approach

4.1 Technical Management

4.1.1 General Approach

The SM21 JALTD will use several Integrated Product Teams (IPT) and control mechanisms to manage the technical engineering development of the project as outlined in the basic Project Management Plan (PMP). A critical tool, which will be used to manage the technical efforts, is the detailed project plan maintained on the Project Management Information Management System (PMIS). The project plan and PMIS will be used to monitor and control the system engineering activities. Each IPT has an assigned IPT leader and individual project managers for each project assigned to the IPT. Projects are associated with contract line item numbers (CLIN) or deliverables.

The technical committee, headed by the Chief Technology Officer (CTO) will be responsible for overseeing the technical management of the SM21 JALTD in coordination with the IPT leaders, other project committees and staff, and the SM21 Program Manager as defined in the basic PMP. Please refer to the PMP for additional details.

4.2 Requirements Management

4.2.1 General Approach

The SM21 JALTD functional and technical requirements, including derived requirements, will be captured with customer involvement and documented in a Unified Modeling Language (UML). Requirements Change Requests will be documented and controlled as a part of the configuration control management process. Any derived requirements for individual components will be added to the requirements as they are obtained from the military and commercial component providers. The establishment and maintenance of the requirements is the responsibility of the Technical Committee.

4.2.2 Project Requirements

The requirements, which will be managed by the Technical Committee and maintained on the PMIS, will contain all requirements given in the project Statement of Work (SOW) or developed during the Demonstration Planning and Assessment process. The requirements will be updated with approved Requirements Change Requests (RCRs) as defined in the basic PMP. This list will be inspected and coordinated with all affected project elements. The establishment and maintenance of RCR is the responsibility of the CTO.

4.3 Development Strategy

4.3.1 General Approach

The technical approach will use a phased approach to deliver incremental capability leading to the full JALTD developed capabilities. A modified spiral development model will be followed to provide a series of evolving formal development demonstrations, to be detailed in the SM21 JALTD project plan maintained on the PMIS. The underlying technologies to demonstrate will potentially include decision support tools as previously discussed. Additional candidate tools may be contributed from participating commercial and military partners.

It is anticipated that the SM21 JALTD capabilities will be demonstrated and tested by USTRANSCOM during at least one force deployment event. Coordination is currently underway with USTRANSCOM to develop demonstration objectives for the first SM21 JALTD demonstration to be held in conjunction with a force deployment in the PNW. The project would be a cooperative effort between the SM21 JALTD and the CCDoTT APS project as previously described.

Working with ONR, the SM21 JALTD program will continue to coordinate additional formal cooperative agreements with the Joint Forces Command – Joint Force Projection ACTD and the Defense Logistics Agency - Nodal Management and Deployable Depot ACTD (NoMaDD). The process for establishing the formal agreements has been identified as the establishment of a Memorandum of Agreement (MOA) between ONR and the DoD Supporting Agency. A timeline for establishing the individual MOA will be arranged with ONR before September 29, 2006. The two potential cooperative ACTD programs are summarized below:

The Joint Force Projection ACTD will demonstrate the technologies and operational concepts necessary to provide combatant commanders with the tools, decision aids, and processes needed to support the analysis, planning, execution, and assessment of force projection for a joint capabilities-based force. Before sufficient control over the deployment and distribution pipeline from end-to-end can be exercised, the stove-piped processes, systems, and data underlying the pipeline must be integrated. The product will be a single, integrated force projection picture that links operators and logisticians at Service, Joint, and Agency levels by using real-time, web-based, and network-centric information systems. The associated processes, Concept of Operations (CONOPS), Joint Tactics, Techniques and Procedures (JTTPs), and tools will be combined to support the U.S. Joint Forces Command (USJFCOM) Joint Force Projection vision.

NoMaDD ACTD: Implements a deployable end-to-end ("factory-to-foxhole") distribution system, including asset visibility using radio-frequency identification.

An additional cooperative effort will be coordinated with the Defense Information Systems Agency (DISA). The DISA Global Information Grid Enterprise Services Engineering directorate (GE) has broad responsibilities for the rapid transfer of technologies to the war-fighter. Within the GE directorate, the Advanced Concepts and Technology Division provide technical

management for DISA's Advanced Concept Technology Demonstration's (ACTD) program. ACTDs facilitate the rapid transfer of advanced information technology from research and experimentation stages to deployment and full-scale implementation within the DoD Global Information Grid (GIG).

A cooperative agreement will be considered through negotiation with several commercial stakeholders and partners as outlined below:

Boeing Corporation and SM 21 have entered into a mutual non-disclosure agreement as a pre-requisite to a Memorandum of Agreement. Boeing is already a major tenant at the Victorville facility involved in aircraft maintenance and certification and a prime candidate to utilize SM 21 Global Logistics and Security Academy education, training, and workforce development capabilities. It is anticipated that this arrangement may emerge as a model for other similar agreements with individual companies or consortia. Under the agreement Boeing is expected to provide access to state of the art modeling and simulation facilities in Anaheim, California, and test and experimentation facilities for aircraft loading in Long Beach, California, access to the Boeing maintained Iridium satellite network for end to end tracking of DoD shipments, joint evaluation of emerging technologies such as the Joint Modular Intermodal Distribution System (JMIDS) and the 5QuadPOD$^{\text{Pat Pend}}$ (5QP) System and co-development of joint capabilities such as the application of ICODES intelligent agent technology to aircraft stow planning replacing AALPS software in the military and eventual commercial multi-modal environment at the Victorville site. The Boeing - SM 21 agreement may also provide for part time personnel assignments and exchange opportunities.

Inteligistics: Class VIII distribution processes as a forum to address larger deployment and distribution capability gaps associated with the Joint Deployment and Distribution Enterprise (JDDE). Specifically, SM 21 would employ the technologies involved in developing the 5QuadPOD$^{\text{Pat Pend}}$ (5QP) system as a warehouse in motion to provide significant enablers across numerous deployment and distribution programs associated with the JDDE with an initial emphasis on Class VIII distribution. The intent is to experiment and demonstrate different aspects of the 5QP system that will fill capability gaps identified during the SM 21 capabilities based assessments. Additionally, the SM 21 JALTD with Inteligistics will explore the possibility of future demonstrations focused on how the 5QP system, or a subordinate component, can enhance force deployment capabilities. The belief is that the system can reduce the footprint of deploying units, particularly of theater opening packages. Reconfigurable containers, with nested inventory control technology have the potential to reduce the current Reception, Staging, Onward Movement and Integration (RSOI) time. Additionally, the 5QP system would reduce the time to inventory parts as units draw pre-positioned stocks and provide the appropriate sized container configurations to transport stocks once issued from TEU sized pre-positioned containers.

Savi – Lockheed Martin: The SM21 JALTD is working with Savi to establish a cooperative agreement to develop improved use of RFID for force deployment and sustainment distribution. Business process re-engineering related to the integration of RFID is a major part of this potential cooperative agreement.

4.4 Rapid Development Techniques

4.4.1 Agile Development

Because the SM21 JALTD has adopted the methodology of agile development, one key benefit will be that there will be early experiments and demonstrations of the most critical hardware, software, and operational elements of the project. These early efforts will serve several purposes in the development process:

1. Provide a focus for communicating with stakeholders to elicit requirements
2. Prove critical functionality early in the project thereby reducing schedule risk
3. Serve as a basis for conducting additional demonstrations and experiments
4. Enable communication with in the project to refine the definitions of key interfaces, and
5. Provide early identification of performance issues and assistance in factoring functionality into hardware, software, and operational elements

Every IPT team (IPT Leaders and individual Project Managers) on the project will post its work for other teams to see on the project web site. This includes posting working models and documents. This begins with the systems engineering team which has posted and continually updates the UML models that will define the requirements and concepts for the system. It continues with each development team working in specific areas of technology. Required hardware will be demonstrated at the earliest possible stage. Working hardware demonstrations will be collected in the laboratory at the Victorville facility where all project members may access and exercise them.

Because the SM 21 project will be focusing on the most critical requirements first, these early working prototypes will demonstrate those requirements early in the program. Pruning this critical functionality early will substantially reduce future cost and schedule risk. This allows the refinement of requirements in the validation of concepts and design approaches to be a continuous process throughout the project instead of being loaded on to the back end.

Because the project is using UML 2.0 as a common requirement and concept development language, it will be possible to incorporate elements of Model Driven Architecture into the process [MDA, 2006]. Two areas where this will be done are:

1. communication, and
2. modeling and simulation

In the communication area, the Network Centric Operations Industry Consortium (NCOIC) will use UML to model elements of the system that need to communicate with other elements [NCOIC, 2006]. Their Network Centric Analysis Tool (NCAT) will then be used to study the communication architecture of the system and make recommendations to the project Re: communication techniques and protocols that are most suitable for certain communication needs based on the characteristics of the communication. In the modeling and simulation area, the models and simulations being developed for the SM21 JALTD - JPPSP (military element of the Victorville facility) will be derived from the UML descriptions of that modeling and simulations

being developed as part of the systems engineering task. A key advantage of using Model Driven Architecture early in a project to create executable representations of the concepts and requirements models is that it leads to early identification of gaps and poorly defined interfaces.

Because early working prototypes will be used for demonstration purposes with stakeholders, the project will be able to make continual adjustments to its concepts, requirements and design approaches based on feedback from those demonstrations. Producing early working prototypes early and often (typically once a week) will also enable the injection and experimentation with new technologies to occur at the rate of advancement of those technologies. Using this process, demonstrations and experiments can more rapidly lead the project in the right direction than if they were done only at the conclusion of the project.

A key principal of the agile development methodology adopted by the SM 21 project is allowing agile teams to mostly manage themselves. The availability of early working prototypes of all elements of the system enables direct communication between developers on various teams. This avoids the communication difficulties of hierarchical organizations as well as the non-productive focus on documentation emphasized by older development methodologies.

4.5 Configuration Management

4.5.1 Responsibility.

Configuration management will be the responsibility of the CTO and IPT leaders. All future SM21 JALTD software builds will be integrated and tested using a controlled software integration process. Please refer to the PMP for the overall description of the CM process.

4.6 Critical Events Schedule – Calendar Year 2006

The following critical events exist for the SM21 JALTD for calendar year 2006. This list will be updated quarterly:

Initial Capability Plan Completion	August 31, 2006
Technical Plan Completion	August 31, 2006
USTRANSCOM PNW Planning Meeting	September 15, 2006
Project Management Plan Completion	September 29, 2006
Multi-modal terminal operating system specification	October 15, 2006
Southern California Agile Supply Network Model	Date under revision
Assessments and Demonstrations:	
- FY 05 Annual Assessment (PNW)	Spring 2007
- Future Annual Assessment Dates	TBD by November 30, 2006
- RFID Integration Experiment	Initial Experiment December 2006
- Use of Advanced Camera and Digital Image Technology	Initial Experiment December 2006

SECTION 5

5.0 Systems Engineering Plan

5.1 Application to Life Cycle Phases

The SM21 JALTD Program is in the Concept Refinement stage. During this stage, systems analysis efforts as defined in this Systems Engineering Plan will be conducted to support requirements elicitation, requirements definition, and the development of system concepts (that is, alternative conceptual system designs) supporting those requirements. Technology and risk assessments will be conducted, primarily through the use of trade studies. Preliminary cost, schedule, and other estimates will be produced based upon the results of the systems engineering effort and will be included in the business cases that are developed for each set of system Requirements and Concepts.

5.2 System Capabilities, Requirements, and Design Considerations

As the SM21 JALTD program is currently being initiated, the systems engineering work needed to produce the outline of overall validated capabilities, concepts of operations, and requirements is ongoing. As the systems engineering results become develop, this section will be updated to reflect current project statements of capabilities, concepts of operation, and requirements.

The SM21 JALTD program will develop a dual use[8] system with the commercial sector being the dominate user of the distribution facilities, assets, and infrastructure included in the system. While the commercial sector is the dominate user of the distribution system, the JPPSP is an important element of SM21. A major design consideration for the JPPSP prototype development will be the use and integration of existing and emerging commercial distribution and multi-modal management concepts augmented by research and development of advanced transportation and information management technologies and processes to change the focus of force projection operations from mobilization at installations and depots to flexible and responsive support from ports of embarkation to the war-fighter executing expeditionary operations.

The JPPSP represents a node within the envisioned Joint Deployment and Distribution Enterprise (JDDE) to manage and regulate the deployment and distribution flow as envisioned in the Joint Logistics (Distribution) Joint Integrating Concept. The JPPSP will be developed as a prototype node, for future determination of requirements and capabilities for other similar nodes (like a Sea Base, ISB, Theater Distribution Center Etc).

5.3 SE Organizational Integration and Technical Authority

The systems engineering organization for the first year of the SM21 JALTD program is limited. The efforts of the systems engineering organization will be overseen by the CTO. A Technical Committee has been designated by the SM21 Program Manager and will act as an advisory staff

[8] The term dual use in this context refers to the use of the system by both the commercial and defense sectors.

to the CTO. The Requirements and Concepts development work done under the systems engineering effort will be provided to the CTO for review. Completed elements of the system architecture will be made available to the Technical Committee and other internal and external SM21 stakeholders for use in decision-making efforts. As the SM21 JALTD program matures, Requirements and Concepts developed prior to this plan will be required to evolve to a nature consistent with the SEP.

5.4 Systems Engineering Process

5.4.1 Introduction

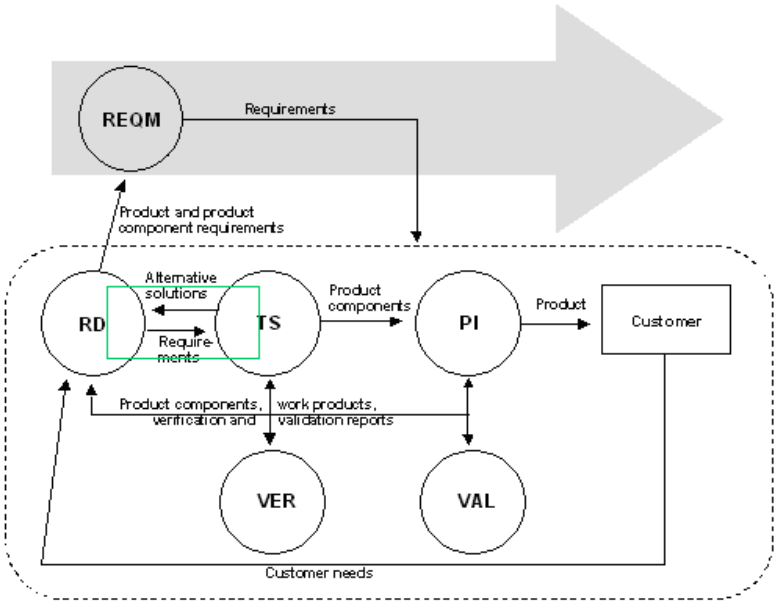
This initial draft of the systems engineering plan addresses the early stages of requirements and concept development. Future versions of this plan will add material appropriate for later years of the SM21 project. The techniques to be used are described following the process areas of the overall engineering effort as in the Software Engineering Institute's Capability Maturity Model (CMMI) model [SEI, 2002]:

In the CMMI, Engineering has these process areas:

1. Requirements Development (RD)
2. Requirements Management (REQM)
3. Technical Solution (TS)
4. Product Integration (PI)
5. Verification (VER), and
6. Validation (VAL).

The process areas in this model are illustrated in Figure 3.

Figure 3 – The CMMI Process Areas



In SM21, the development of Requirements and Concepts will be treated as a single process. This is alluded to by the two arrows in Figure 3 that show requirements feeding from Requirements Development to Technical Solution and Alternative Solutions feeding back from Technical Solutions into Requirements Development. This area is shown in the green box in Figure 3 is the subject of much of the systems engineering effort during the first year of SM21. The process area in the green boxes referred to as ***Requirements and Concepts Development*** and is discussed further in Paragraph 5.6. It represents the development of Requirements and Concepts together. Also note that since one purpose of the early stages of concept refinement is to trade-off alternative sets of Requirements and Concepts, there are actually neither a single set of requirements, nor a single technical solution during this phase of development. Instead, alternate sets of Requirements and Concepts are developed and the best chosen for further refinement. The portion of Requirements Development outside of the green boxes referred to as requirements elicitation and is discussed further in Paragraph 5.5.

5.5 Requirements Elicitation

In the early stages of project requirements elicitations, the requirements must be determined through direct interaction with stakeholders. Such direct interaction is best done face-to-face with one or more stakeholders at a time. Stakeholders, representing a wide variety of backgrounds, experience, and view points, are being consulted to provide their desires, wishes, and goals for SM21. The systems engineer will capture, translate and format those desires, wishes, and goals into requirement statements in a consistent manner for use in SM21 projects. The process of precisely eliciting and characterizing business goals has always been problematic. Business goals come in many forms and at many levels of abstraction, and the stakeholders of the system are usually not accustomed to making goals explicit [Kazman, 2005]. Requirements Elicitation is the process of acquiring these goals from stakeholders and processing the goals into a consistent set of requirements for use within the SM21 program.

The identification of stakeholders' goals is a complex issue [Kavakli, 2002]. No single technique is effective in identifying goals in all situations. The primary techniques that may be used in goal-oriented requirements engineering in SM21 are:

1. Ethnography,
2. Focus groups,
3. Interviews,
4. Issues lists,
5. Models,
6. Data gathering from existing systems,
7. Requirements categorization,
8. Conflict awareness and resolution, and
9. Prototyping

Within these major areas, some of the following techniques might also be used:

1. Understanding stakeholders' problems and negating them.
2. Extracting intentional statements from:
    a. interview transcripts,

   b. enterprise policies,
   c. enterprise mission statements,
   d. enterprise goals,
   e. workflow diagrams, and
   f. scenarios written with stakeholders.
3. Asking "How" and "Why" questions about these initially identified goals in order to go up and down the goal hierarchy.
4. Asking "How else" questions to identify alternative goals [Kavakli, 2002].

UML diagrams will be used as a primary modeling technique for communication between the systems engineer and stakeholders. Several software development approaches, including the Unified Software Development Process, recommend use cases for users' requirements description [Som, 2004]. However, the SM21 JALTD program will not be using use cases exclusively for the purpose of communicating between systems engineers and stakeholders because they have many shortcomings when used in requirements engineering. For example, context diagrams are good tools for describing scope in a simple outline form for communication with stakeholders. Unlike use-case diagrams, context diagrams indicate interfaces and the information or materials that must come in or out of them, rather than just roles (that is, UML actors) [Alexander, 2006]. In UML, a scenario is a path through a use case that organizes a sequence of instances of roles in a use case as they occur in time. [Alexander, 2006]. In this manner, scenarios use the element of time to translate goals into connected stories.

Goals often conflict, but requirements must not. Some conflicts will be obvious from a plain list of goals; while others are easier to see if goals are organized into a UML model. This will assist in conflict awareness and resolution. Goals may also be categorized by developing affinity diagrams. (The affinity diagram was originally developed by Jiro Kawakita, an anthropologist, to discover meaningful groups of ideas from a raw list. Kawakita's idea is to examine the list and let groupings emerge naturally, using the right side of the brain, rather than following a preordained categorization [Kazman, 2005].)

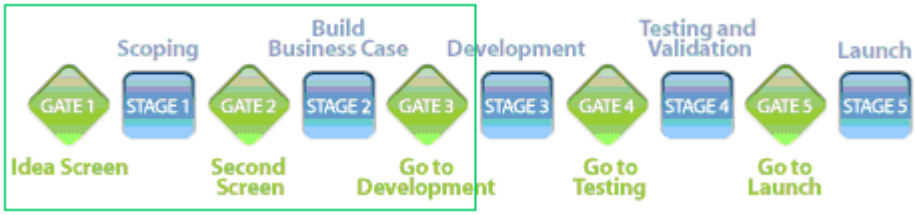
Systems, resulting from the SM21 development effort, need to meet both functional requirements (FR) and non-functional requirements (NFR). In the SM21 program, UML will be used as a basis for organizing both FR's and NFR's in association with UML model elements [Supakkul, 2005]. Diagrams showing the both models and requirements will be used in the continuing dialogue with stakeholders. Through this dialogue, requirements will be continually refined throughout the SM21 program.

5.6 Requirements and Concepts Development

Requirements development begins with the collection of new potential Requirements and Concepts. Information contained in the SM21 Initial Capabilities Document, and work done through Center for the Commercial Deployment of Transportation Technologies MOU #07-291604, FY 04 Project 5 tasks 5.1 through 5.8 will provide initial research and analysis to begin identifying candidate Requirements and Concepts. This material represents potential Requirements and Concepts that requires additional screening or business case development.

The SM21 JALTD program will use multiple stages of screening to determine which Requirements and Concepts should progress further into the development process. The screening processes constitute gates through which sets of requirements and associated concepts must make it before advancing on to the next stage in the development process. This concept was popularized in the stage-gate product innovation process described in [Cooper, 2001], and is illustrated in Figure 4. The green box in the figure encloses the portions of this process that will be used in the first year of SM21. The green box in Figure 4 matches the green box in Figure 3 and shows how the feedback process between Requirements Definition and Technical Solution Development actually takes place (through decisions that result in the refinement and iteration of previous process stages).

Figure 4 - The Stage-Gate Product Innovation Process



The steps to be followed in the SM21 systems engineering process for requirements and concept development are:

1. An idea screening of new potential Requirements and Concepts. These idea screenings do a quick analyses of the feasibility of the potential requirement or concept based upon such simple factors as cost, schedule, and technological maturity
2. Scoping the effort necessary to meet new potential requirements and develop implementing concepts. This includes elaborating the Requirements and Concepts necessary to implement them to sufficient detail so that the maturity of technologies to be applied and the level of effort required for new development, including integration efforts of existing technologies or COTS solutions with new development, will be determined.
3. A second screening of resulting scoped Requirements and Concepts will then be conducted. This will be a more in-depth screening effort and likely involve the employment of studies, especially trade studies to select among alternate concepts and/or alternate sets of requirements.
4. A full "business case" will be developed for satisfying a set of scoped requirements and developing the attendant concepts. This business case will include evaluating the cost, risk, schedule, and other pertinent aspects of the development effort against likely program funding.

Decision-making during the screening processes will be accomplished by various studies and analyses, including trade studies described further in Paragraph 5.13, Trade Study Methodology. Trade Studies will be used for contrasting multiple alternatives. Simpler evaluation techniques will be used where there is a single set of Requirements and Concepts under consideration when the decision is made at a particular stage.

Requirements and Concepts development and attendant documentation will be accomplished by using Unified Modeling Language (UML). The models, constructed using UML, will represent simplifications of reality to help to understand a part or all of the SM21 Requirements and Concepts definition process.

UML diagrams are the graphical device that will be used to construct and view models. The following types of the diagrams and related UML artifacts are likely to be used in the SM21 systems engineering effort:

1. Activity Diagram
2. Class Diagram
3. Communication Diagram
4. Component Diagram
5. Interaction Overview Diagram
6. Object Diagram
7. Package Diagram
8. Sequence Diagram
9. Use Case Diagram
10. Technical Glossary

The UML models that are likely to be used in SM21 system engineering include:

1. Business Process Model
2. Requirements Model
3. Use Case Model
4. Domain Model
5. Data Model
6. Class Model
7. Component Model
8. Project Model
9. User Interface Model

A view is what we see when we look at a model or set of models from one point of view; in particular, the viewpoint of a particular stakeholder (see Paragraph 5.5). We will use views in the SM21 JALTD program to communicate the needs of stakeholders. Views will be constructed to deliver information to the stakeholder or the stakeholder's clients. In this sense, the need for a view is dictated by the need to get information to the stakeholder as part of the requirements solicitation and requirements review processes. The list of views will be developed once the list of stakeholders is better defined.

Note that no formal documentation, such as requirements documents, will be produced by the systems engineering effort of SM21. This is in keeping with the use of agile development processes in the systems engineering effort. Instead, requirements will be included explicitly in the UML models where possible, and annotated as notes to the models in cases where including requirements is not possible (for example nonfunctional requirements). The collection of UML models will serve as both requirements and concept documents.

5.7 Requirements Management

Requirements are managed by maintaining the UML models into which the requirements are embedded. Periodically, these models are given version numbers and are published as project documents. The alternative sets of requirements and related concepts that are developed to support particular study efforts will be separately given version numbers, will be reviewed by the Technical Committee and then published.

5.8 Development

The portion of the engineering effort lying outside of Requirements and Concepts development (the green box and Figure 3) and a Requirements Elicitation (a portion of Requirements Definition (RD) not contained within the green box in Figure 3) will be performed by various subcontractors who are developing special-purpose software or acquiring and installing commercially available off-the-shelf solutions (COTS). The UML models developed as a result of the systems engineering effort will support work in this portion of the process area, and provide guidance for these efforts to follow. Note that because development is the province of each individual subcontractor and each contractor has its own unique development techniques, this SEP will provide project level development plans and project standards for how the engineering efforts are to be conducted by these subcontractors; however, individual sub contractors at their discretion, may continue to use their own developmental techniques that they are more comfortable in using. If a subcontractor chooses to use their own developmental processes, they will be required to produce their own development plans to be submitted as an annex to this document. It is also inappropriate to produce extensive formal development plans in an early-stage research and development projects such as SM21 but once the program transitions to a full development effort such plans will be produced as necessary.

5.9 Product Integration

Systems Engineering efforts will be coordinated with the CTO and Technical Committee before being made available for other team efforts. The Product Integration Plan is a part of the basic PMP.

5.10 Verification

Systems Engineering efforts will be coordinated with other team efforts. Solutions proposed as the result of System Engineering work will be staffed through the CTO for referral to the Technical committee or to the appropriate project agencies appropriate project agencies to validate they provide appropriate solutions in accordance with project objectives. The UML models developed as a result of the systems engineering effort will support work in other process areas. The SM21 Quality Control and Validation and Verification Process are provided in the SM21 PMP.

5.11 Validation

Systems Engineering efforts will be coordinated with other team efforts. Solutions proposed as the result of System Engineering work will be staffed through the appropriate project agencies to validate they provide appropriate solutions in accordance with project objectives. The UML models developed as a result of the systems engineering effort will support work in other process

areas. The SM21 Quality Control, Verification, and Validation processes are provided in the SM21 PMP.

5.12 Modeling and simulation

Modeling and simulation efforts planned as part of the SM21 program will be employed to support the systems engineering effort. The designs for some of these efforts will require future adjustments to ensure they provide the information needed for making systems engineering decisions. As the Technical Plan is published current modeling and simulation efforts are under reviewed with a goal of increasing future support to the systems engineering process. Additionally, better definition of the SM21 Requirements and Concepts will result in more highly focused modeling and simulation efforts, which in turn will support the refinement of Requirements and Concepts.

5.13 Trade study methodology

The technique of choice for performing trade studies is by the application of linear multi-attribute value theory. Trade studies done using this technique rate a set of alternatives, each set of alternatives using a number of different qualities to arrive at a solution. Such qualities are often ones whose values are used as metrics to determine the goodness of the solution. Examples include: expandability, reliability, cost, risk, performance, flexibility, and security. It is important that a uniform set of criteria be used throughout all trade studies done in the project. For each trade study, each criterion is assigned a weight from zero to 100 with a total of all the weights being 100. Each solution is evaluated for each criterion and given a score from zero to 100. The sum of all the weighted scores represents the value of the solution and the solution with the highest value is selected as the result from that trade study.

5.14 System Engineering Technical Management and Control

The SM21 Project has established an integrated project and technical management plan to mitigate or eliminate the top Systems Engineering issues identified by the commercial and government sectors as summarized below[9]:

- Lack of awareness of the importance, value, timing, accountability, and organizational structure of SE on programs
- Lack of adequate, qualified SE resources
- Insufficient SE tools and environments to effectively execute SE on programs
- Poor initial SE program formulation
- Inconsistent and ineffective requirements definition, development, and management.

SM21 will work to mitigate or eliminate SE issues as the project matures. During the first year of the SM21 JALTD program we assigned one SE as the Senior Project Software Engineer. As the program matures technical management and control will be scaled as appropriate.

Because we are following agile development processes, there will be no single technical baseline

[9] Based on an National Defense Industry Association Study in January 2003

as that term is commonly used. Instead, there will be multiple sets of concepts and requirements each representing a candidate baseline at each stage during the Requirements and Concepts definition process. These sets of Requirements and Concepts will be reduced at each stage of the process as trade studies will be used to make decisions at stages between process steps. However, it is expected that at the end of the first year there will still be multiple sets of concepts and requirements to be further refined, as required, during the second and third years of the project and by the use of techniques including: prototyping, additional trade studies, and experimentation. In addition, Requirements and Concepts will continually be defined through interaction with stakeholders in the project.

Appendix A: Risk management

A.1 Introduction

Risk management is the process of assessing risk and developing strategies to manage it [Wiki, 2006]. The SM 21 program will use the process defined below for risk management. This process includes the continuous application of the following three steps:

1. Risks will be identified.
2. Risks will be assessed.
3. Risks will be treated.

The SM 21 program strategy to implement each of these steps is explained in more detail in a subsequent subparagraph. Risks will be identified and assessed continuously and these assessments will be used in decision-making throughout the project to treat the effects of risks. Risks will be carried forward and dealt with until they are resolved or they turn into problems and are handled as such.

A.2 Risk identification

The first step in the process of managing risk is to identify potential risks. Risks are defined by events that, when triggered, cause problems. The SM 21 program will identify risks based both on the sources of problems that trigger the events to occur (source analysis) as well as the problems caused by the events (problem analysis). An example of a risk uncovered by problem analysis is the failure of a group of stakeholders to accept the solution proposed by SM 21. The same risk might be uncovered by source analysis when the events that might be triggered by poor communication between the SM 21 project and external entities are considered.

The SM 21 project will use checklists as an aid to identifying both problems and sources that need to be considered during risk identification. For software-intensive elements of SM 21, the list in Figure A-1 (Taxonomy of Software Development Risks) of the publication *Taxonomy-Based Risk Identification* [Carr, 1993] will be used as an aid to identifying potential project risks. For other elements of the project -- including hardware intensive elements and operational procedure based elements -- checklists of the items that should be considered in risk identification will be developed and maintained by the project. The baseline taxonomy that will be used is the Federal Enterprise Architecture Consolidated Reference Model Document [CRM, 2006], [FEA, 2006].

A.3 Risk assessment

The second step in the process of managing risks is the assessment of identified at risks to determine their probability of occurrence and their consequences. This step enables a prioritization process to be followed whereby the risks with the greatest consequences and the

greatest probability of occurring are handled first, and risks with lower probability of occurrence and fewer consequences are handled later. The SM 21 project defines risk in this sense as the product of the probability of occurrence of the event and the monetary impact of the event:

Risk = (probability of occurrence) X (monetary impact)

Probability of occurrence is the number between zero and one. The monetary impact is in dollars and is determined by the cost and or schedule effects if the event occurs. The numeric values of risk created by this assessment will be used in risk treatment strategies discussed in the next subparagraph.

A.4 Risk treatment

The third step in the SM 21 risk management process occurs after risks have been identified and assessed. This third step is determining a method by which the risk is handled or treated. Techniques to treat risk may be divided into one or more of four major categories: [Dorf, 1997]

1. transfer,
2. avoidance,
3. mitigation, and
4. acceptance.

Risk transfer in the context of the SM 21 project, means causing another party to accept the risk. An example is convincing an on going DOD program to accept responsibility for the development of an interface with a high degree of risk.

Risk avoidance, in the context of the SM 21 project, includes not performing an activity that could carry unacceptable risk. An example is deferring work involving a new technology until the technology has demonstrated both its effectiveness and its acceptance in the marketplace. Specifically, the project will apply the *diffusion of innovations theory* that was formalized by Everett Rogers [Rogers. 2003] to avoid using technologies too early in their life cycle. This theory divides adopters of any new technology into five categories: innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%) and laggards (16%), based on a bell curve. The project will avoid using any technology at the innovator or early adopter stage.

Risk mitigation, in the context of the SM 21 project, involves methods that reduce the problems caused if the events triggering of the risk should occur. Risk mitigation is the primary technique likely to be used by the SM 21 project in treating risk. The primary techniques employed by the SM 21 project to mitigate risk are those associated with the discipline of agile development [Ambler, 2004], [Agile, 2001]. Specific techniques the project will use are listed in Table A-1.

Table A-4 Risk mitigation in agile development

Technique	Effectiveness
UML 2.0 as a common modeling language	Reduces the risk of miscommunication because diagram elements and connectors have explicitly defined meanings. Increases the ease of communication both within the project and with stakeholders.
Focus on critical requirements first	Focusing on the most critical, or "driving", requirements first when combined with other techniques like early and frequent builds, exponentially reduces schedule risk by forcing those features that can be most justified to be implemented first.
Early and continuous communication with stakeholders.	Reduces the risk of elements of the project not satisfying stakeholder needs.
Early and frequent builds.	Early prototypes become vehicles for eliciting additional requirements and for demonstrations and experiments. Miscommunication is avoided. Performance and development issues are identified early.
Continuously evolving requirements.	By recognizing that requirements will continue to evolve through out the project's lifetime, it is possible to mitigate the effects of changing requirements by building system elements with re-factoring in mind.
Experimentation.	Because there will be early and frequent builds of system elements (both hardware and software), it will be possible to conduct informal experiments with stakeholders to refine both requirements and design approaches.
Modeling and simulation.	By modeling and simulating key system elements prior to their development, costly mistakes and over or under sizing system elements may be avoided. By simulating and emulating the functionality of key system elements before they are implemented or available, the length of time available to test these elements will be extended and risk will thereby be reduced.
Refined processes.	At least once a month, the team will reflects on how to become more effective, and then tune and adjust its behavior accordingly.

Risk acceptance in the context of the SM 21 project involves accepting the loss when it occurs. A degree of risk must be accepted in any research and development program.

A.5 SM21 Project Risk Table

An SM21 Project Risks table as formatted below will be completed quarterly with risks listed in numeric order - highest to lowest.

Identification	Assessment	Numeric value	Treatment

Figure A-1 SM 21 Project Risks

A process will be identified whereby any project participant may submit a newly identified risk for inclusion in the table. The table will be updated at least once a week and will be discussed on an exception basis during weekly status teleconferences as well as item by item at each quarterly review.

Appendix B: Technical Committee Decision Document

Project Status and Decision Document

This is Decision Document format is intended as a vehicle for Technical Committee to record and communicate their assumptions, decisions, remaining open questions, and need for information, for the attention of the SM21 Management Group. Since this will be maintained as a living document, it is important to consider the date of each item, particularly in the ***Assumptions*** and ***Decisions*** sections, because later entries relating to the same topic may supersede prior entries.

Updates of this document are largely based on discussions and agreements reached during meetings of the Technical Committee. Summaries of meetings and conference calls will be maintained using the following format:

Date of Meeting:

Attended by: List the names of attendees

The contract currently involves the following active (i.e., funded) contractors:

1. **Assumptions:**
   1.1 [Date(s) assumptions were established or modified]
2. **Decisions:**
   2.1 [Date of decision]
3. **Questions:**
   3.1 [Date question was raised]
4. **Information Needs:**
   4.1 [Date information need was established]
5. **Pending Issues and Actions:**
   5.1 [Date of pending issues and actions]
6. **Plans and Schedules:**
   6.1 [Date plans and schedules were established or modified]
7. **Action Items:**
   9.1 [Dates action items were established and assigned]

Appendix C: Acronyms

ACTD –	Advanced Concept Technology Demonstration
Agile Port System –	APS
AIT –	Automatic Identification Technology
CCDoTT -	Center for the Commercial Deployment of Transportation Technologies
CLIN -	Contract Line Item Number
COI –	Critical Operational Issue
CONOPS –	Concept of Operations
CRM –	Consolidated Reference Model
CTO –	Chief Technology Officer
DDE –	Data Dissemination Environment
DFWG -	Distribution Functional Working Group
DISA -	Defense Information Systems Agency
DST –	Decision Support Tools
DTS –	Defense Transportation System
EDI –	Electronic Data Interchange
ERDC -	U.S. Army Engineer Research and Development Center
ERP -	Enterprise resource planning
FISMA -	Federal Information Security Management Act
FR –	Functional requirements
GE -	Grid Enterprise
GIS -	Geographic Information System
GOTS -	Government Off-The-Shelf
ICD -	Initial Capabilities Document
ICODES -	Integrated Computerized Deployment System
IPT –	Integrated Product Team
IRRIS -	Intelligent Road/Rail Information Server
JALTD –	Joint Advanced Logistics Technology Demonstration
JDDE -	Joint Deployment and Distribution Enterprise
JIC -	Joint Integrating Concept
JFCOM -	Joint Forces Command
JFRG II -	Joint Forces Requirements Generator II
JLETT –	Logistics Experimentation and Training Test-bed
JOCD -	Joint Operational Concept Document
JTTP -	Joint Tactics, Techniques and Procedures
MOA -	Memorandum of Agreement
MoE -	Measures of Effectiveness
MoP –	Measures of Performance
NCAT -	Network Centric Analysis Tool
NCOIC -	Network Centric Operations Industry Consortium
NFR –	Non-functional requirements
NoMaDD -	Nodal Management and Deployable Depot ACTD
OACSIM -	Office of the Assistant Chief of Staff for Installation Management

ONR –	Office of Naval Research
PI -	Product Integration
PMIS –	Project Management Information System
PNW –	Pacific Northwest
POLB –	Port of Long Beach
POLA –	Port of Los Angeles
PPP -	Power Projection Platform
UML -	Unified Modeling Language
USJFCOM -	U.S. Forces Command
RCR -	Requirements Change Request
RD -	Requirements Development
RE -	Requirements Management
RFID –	Radio Frequency Identification
RSOI -	Reception, Staging, Onward Movement and Integration
SCASN –	Southern California Agile Supply Network
SCLA –	Southern California Logistics Airport
SPOD -	Seaport of Debarkation
TC-AIMS II -	Transportation Coordinators' Automated Information for Movement System II
TS -	Technical Solution
VAL -	Validation
VER -	Verification

Appendix D: References

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